

**EFFECTS OF HANDLING-DISTURBANCE STRESS ON HEART RATE  
IN THE FERRUGINOUS HAWK (*BUTEO REGALIS*)\***

by

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*Abstract*

The heart rate (HR) of a female Ferruginous Hawk was monitored continuously by telemetry under different handling-disturbance conditions. HR increased approximately threefold when the handler was outside the cage, and invariably reached a maximum (490-502 beats/min) when the handler was inside the cage. Near-maximal HR's were observed when the Hawk was restrained on the ground or held by the handler. On the other hand, hooding the bird during restraint resulted in a slowing of HR to 51-66% of the maximal rate.

*Introduction*

Concern for the status of many raptorial species has led to a proliferation of programs dealing with rehabilitation and captive breeding of the birds of prey. Physiological stress involved with the day-to-day care and handling of these birds is an unfortunate and mostly unavoidable by-product of raptor conservation efforts. In spite of this, little has been done to quantify various physiological factors related to stress experienced by the raptors during daily maintenance.

With the advancement of radio-telemetry techniques, remote sensing of physiological parameters such as heart rate (HR) and body temperature is now possible. Studies of HR fluctuations have been especially promising because evidence (summarized in Johnson and Gessaman 1973) has shown that HR can be a valid indicator of overall metabolic rate. While Lund and Folk (1976) have shown that the HR-metabolic rate relationship is stable regardless of the rate of change and for a variety of behaviors, these authors concur with the majority opinion that HR is only a valid indicator of metabolism at low levels of exercise and when the animal is not under stress (Jones and Wang 1976, Morhardt and Morhardt 1971). Despite this apparent drawback, telemetered HR has been used to show effects of disturbance or restraint in both poultry (Cogger et al. 1974) and game birds (Wooley and Owen, 1977), but to this point, research of this nature has been very limited in raptors. In this report we show the extent of HR elevation resulting from various types of handling-disturbance in a Ferruginous Hawk and how such disturbance may be mitigated.

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### Methods

The female Ferruginous Hawk used in this study was considered nonreleasable because of a broken wing but was healthy in all other respects.

The study was conducted in an isolated section of the Henry Doorly Zoo (Omaha, NE) where the bird was housed in a large (64m<sup>2</sup> × 5 m high) flight cage. A tent outside the cage served as an observation blind and housing for telemetry instruments.

Silver ring ECG electrodes were implanted on the dorsal surface of the bird's sternum using a modification of the surgical method of Sawby and Gessaman (1974). The telemetry transmitter consisted of a 130-g "backpack" fitted to the bird with one harness passing anterior to, and another posterior to, the bird's wings. The Technical Institute of the University of Nebraska at Omaha built the telemetry transmitter designed to cue on the QRS complex of the hawk's ECG, then to amplify and transmit this signal on the FM radio band (Van Slyke 1976). A conventional FM receiver picked up the transmitted signal, and the resulting data were stored on magnetic tape, using a cassette tape recorder. Because of the impracticality of counting the audio "clicks" that represented the actual HR, these stored data were later converted to an analog format in the laboratory using a Physiograph-Cardiotach (Narco Bio-Systems) apparatus.

Data collection involved one "observer" operating the tape recorder and radio in the blind while another "handler" disturbed the bird first by approaching her, then by performing a series of handling operations. HR data during the bird's normal activities and in the undisturbed condition were collected at various times, far removed from the handling-disturbance testing.

### Results and Discussion

A summary of the results is presented in table 1. The slight elevation in HR associated with sound-stimulus is not remarkable as it falls completely within the range for

**Table 1. Effects of disturbances associated with handling and effects of some normal activities on HR.**

Activity	Heart Rate (Range, beats/min.)	% of Maximal
Undisturbed	112-235	22.4-47.0
Disturbed		
Sound: whistle	185-235	37.0-47.0
Handler outside cage	397-502	79.4-100.0
Handler inside cage	490-502	94.0-100.0
Bird held in hands	483-500	98.6-99.0
Bird restrained on ground	400-475	80.0-95.0
Bird hooded	255-329	51.0-65.8
Hood removed	352-502	70.4-100.0
Normal		
Preening	138-227	27.6-45.2
Visual stimuli (e.g. squirrel, birds, etc.)	200-393	40.0-78.3
After flight	188-480	37.6-95.6

the undisturbed bird. The actual record for this type of disturbance did show a quite moderate and transitory increase in HR, lasting no more than 5 seconds following sound stimulus.

In contrast, the dependence of the Ferruginous Hawk on its sense of vision is demonstrated by the greatly elevated HR that occurred when the bird first glimpsed the approaching handler. Although there was some variability to the higher HR when the handler was at a distance, the tachycardia became constant, remaining at a near-maximal value as the handler approached the hawk closely. The cardiac performance then remained essentially unchanged as the handler caught and held the bird.

By holding birds on their back, falconers often report that a so-called hypnotic calming occurs. This effect is, in reality, a part of the overall stress response, and it does appear in the Ferruginous Hawk, but it is interesting to note that the HR in this state remained quite high.

Elevated HR associated with care in the Ferruginous Hawk is presumably brought about by stimulation of the heart's sympathetic innervation in response primarily to visual stimuli. The dependence of the hawk's cardiac physiology under stress on visual stimuli was vividly demonstrated in the tremendous reduction in HR that occurred when the bird's eyes were covered.

HR's associated with some of the normal activities in the hawk's behavior repertoire may also be examined in table 1. The locomotor activity associated with preening did not seem to require circulatory adjustment in the form of elevated HR. On the other hand, when the presence of animals, such as squirrels or smaller birds, outside the hawk's cage could be linked with her behavior, a rather marked tachycardia was invariably associated with the presence of these potential prey species. Even in short flights, e.g., when the hawk hopped from the ground to a perch, a twofold elevation in HR was observed.

The case for hooding a hawk's eyes when working with it is clearly strengthened by these results, while the calming effects of holding a bird on its back are nil as far as metabolic response is concerned. Little can probably be done to lessen the stress response upon approaching a captive raptor, other than to make sure that this phase of handling proceeds rapidly.

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## **WILD TAKEN PEREGRINES BREED IN THE MELBOURNE, AUSTRALIA, ZOO**

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The fact that the Peregrine (*Falco peregrinus macropus*) bred in the Melbourne Zoo in 1976, 1977, and 1978 is by itself no remarkable event. We feel, however, that the circumstances and conditions under which this pair of falcons bred is for several reasons noteworthy. These data were gathered while working on a Peregrine research project sponsored by the Fisheries and Wildlife Division, Victoria, and we are indebted to Mr. Roy Dunn, curator of reptiles at the zoo, for his help and information.

It is now rather well documented that Peregrines will breed in a variety of enclosures, but there has been considerable speculation and discussion, especially at Raptor Research Foundation meetings, as to the optimum age for taking Peregrines for breeding purposes and the conditions that will best promote breeding. Speculation revolves around the question of whether they breed most easily if taken as small nestlings, as fledglings, as first-year migrants, etc., and what sort of disturbances they will withstand. Most would agree that first-year falcons taken on migration are difficult, if not impossible, to breed, and that falcons taken as fledglings kept in relatively secure and isolated conditions are the easiest to induce to breed (cf. Cade et al. 1977). Although we also agree, the data given herein suggest that factors necessary for breeding may vary more widely than expected, but that the "psychological disposition" of the falcons may still be one of the major overriding factors.

The pair of falcons discussed herein arrived at the Melbourne Zoo in about 1972 as adults after having been found injured. They were from different locations and were not mates. The male had a severely broken wing, which left him flightless. The female had a grotesquely deformed mandible that may have been the result of a collision with utility wires, and she probably had other injuries not readily visible. They were placed in a pen constructed of a mixture of chain-link and chicken-wire fencing. The enclosure is rectangular in shape, about 3 m wide on the narrow end by 6.1 m on the long side by 6.1 m high. The pen has walkways on two sides (the narrow ends) that pass immediately next to it. On one side (the long dimension) is a pen containing several little Eagle (*Hieraaetus morphnoides*) and Laughing Kookaburra (*Dacelo gigas*) and on the other side, a pen with several Whistling Kite (*Haliastur sphenurus*) and Australasian Harrier (*Circus aeruginosus*).

The series of pens in this particular row are open on all sides, with a piece of corrugated tin covering about 20% of the roof. Both pens adjacent to the Peregrine pen are